

General Characters of CNS.

1. Protected by bone
2. covered e' meninges.
3. soft (jelly like) (no c.t)
4. Formed of grey matter & white matter (presence of myelin)

Parts of CNS:

I. Brain

1. Cerebrum.
2. Cerebellum.
3. Diencephalon (thalamus, subthalamus, epithalamus)
hypo "
- 4 Brain stem (midbrain, pons & medulla).

II Sp. cord

(31 segment)

8 cervical

12 thoracic

5 lumbar

5 sacral

1 coccygeal.

<u>Grey matter</u>	<u>White matter</u>
Formed of • nerve cells + unmyelinated n. fibres + neuroglial cells.	myelinated nerve fibres + neuroglial cells.
Parts • 2 post. horns + 2 ant. horns + Commissure + [2 lat. horns in thoracic & upper 2 lumbar]	- post. , lat. & ant. columns.
* <u>The post. horns</u> : contain sensory nuclei.	* <u>Post. Column</u> : [bet. dorsal septum & post. horn] Contains ascending tracts only.
* <u>The lat. horns</u> : " sympathetic "	* <u>Lat. column</u> : bet post & ant. horn
* <u>The ant. "</u> " motor nuclei	* <u>Vent. column</u> : [bet. ant. column & vent. fissure]
* <u>The commissure</u> : " commissural "	- the lat & vent. columns contain ascending & descending tracts.

	<u>Cervical</u>	<u>Thoracic</u>	<u>Lumbar</u>
- Outline	Oval	rounded	rounded.
- Site of c.c.	Ventral	slightly ventral	central
- Grey matter	<u>4 horns</u> : - 2 thin diverging post. horns. - 2. thick ant. horns.	<u>6 horns</u> : - 4 thin horns - 2 small lat. horns	<u>4 horns</u> : - 2 thick/ parallel post. horns. - 2 thick ant. horns - lat. horns in L1 & 2
- White : grey matter ratio.	Largest	- large	- smallest.
- Gracil & cuneate	present	- G. & cuneate in T ₁₋₆ small	- Gracil. No cuneate - large

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Pathway of proprioception & fine touch [From body]

Proprioception = sense of position, vibration & movement.

Fine touch = Tactile localisation, tactile discrimination & stereognosis.

Receptors for Proprioception

- Pacinian Corpuscle : in c.t. capsule of joint
- muscle spindle : in muscles.
- Tendon " " tendons

Receptors for fine touch:

1. Merkle's disc
2. Meissner's corpuscle
3. Ruffini organ.

First Order Neuron:

- Large cells of spinal ganglia:-
Have peripheral branch = thick myelinated nerve fibres w̄ receive sensation from receptor. Their central branches enter the sp. cord through the medial division of post. root. The fs. divide into long ascending & short descending branches.
- long ascending fs in sacral, lumbar & lower thoracic segments ascend as gracile tract
- long ascending fs. in upper thoracic & cervical " " Cuneate tract
- Gracile & Cuneate tracts ascend to end on cells of:

Second Order Neuron:

- Cells of Gracile & cuneate nuclei of closed medulla (upper $\frac{1}{2}$) (same side).
- Axons of these cells form int. arcuate fibres w̄ cross to the opposite side forming sensory decussation & form the medial lemniscus. that ascend to end on c-

Third Order Neuron:

Cells of Posterolateral Ventral Nucleus of Thalamus [PLVNT]
Axons of these cells ascend in the sensory radiation to end in the sensory area in the post central gyrus of cerebral Cortex [area 3, 1 & 2].

Lesion of Gracile & Cuneate tracts of the sp. cord →
ipsilateral loss of proprioception & fine touch in the limb below the lesion.

Gracile tract

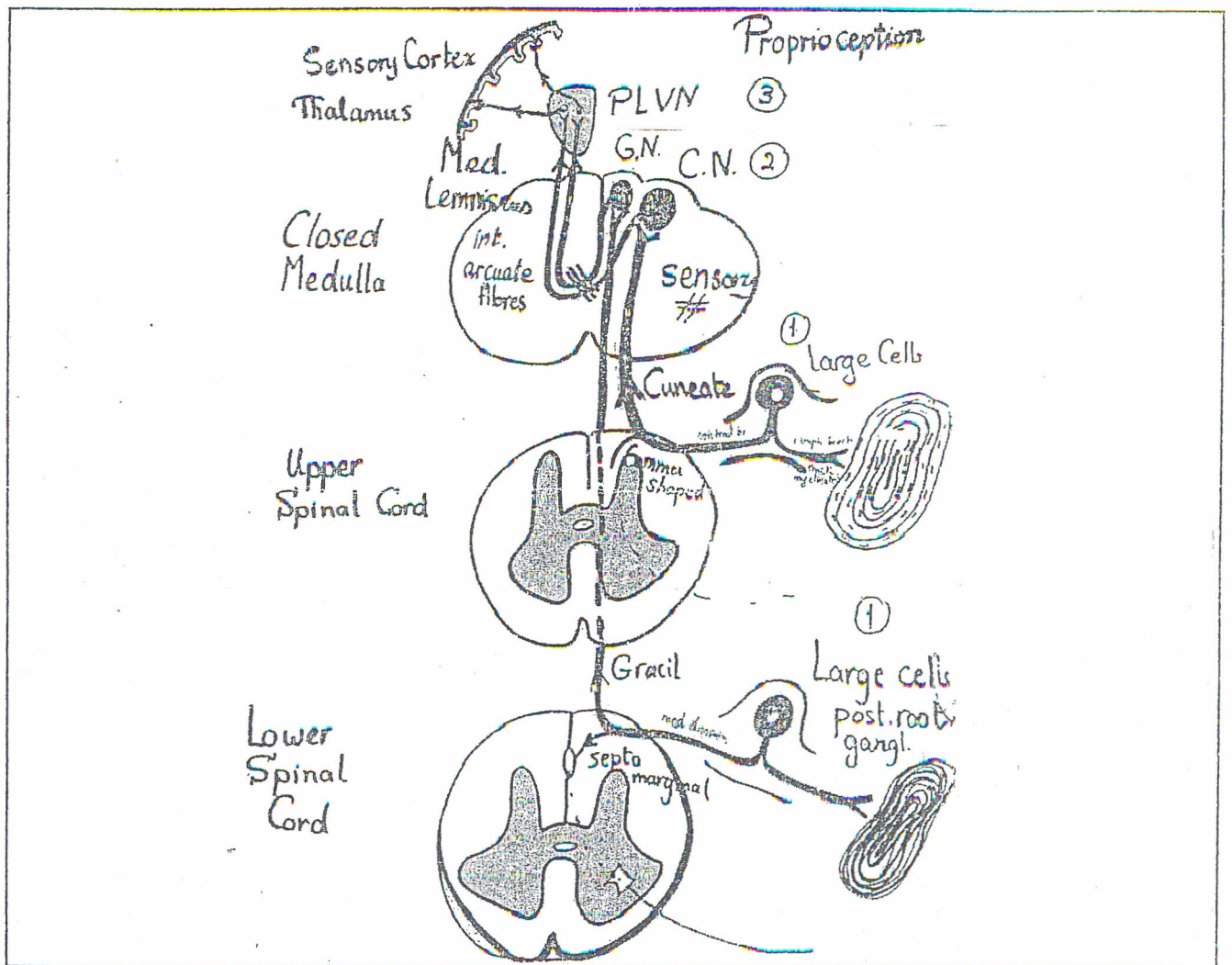
- long ascending sensory tract
- In post. column of white matter of spinal cord (all levels)
- large cells of spinal ganglia of sacral, lumbar & lower thoracic segments
- Their peripheral branches (thick myelinated) " central branches enter the sp. cord through the med. division of post roots. then ascend to terminate in:
- Gracile Nucleus in closed medulla (same side)
- Carry proprioception & fine touch from the lower $\frac{1}{2}$ of the body (same side)

Cuneate tract

- long ascending sensory tract
- In post. column of white matter of sp. cord (In cervical & upper thoracic levels only)
- large cells of spinal ganglia of upper thoracic & cervical segments.
- Have peripheral branches = thick myelinated & central branches w enter the sp. cord through the med. divisions of post. roots. then ascend to terminate in:
- Cuneate Nucleus in closed medulla. (same side).
- Carry proprioception & fine touch from the upper $\frac{1}{2}$ of the body (same side)

Medial lemniscus:

- ascending sensory bundle in the brain stem
- Cells of gracile & Cuneate nuclei of closed medulla of the opposite side
- axons of these cells form internal arcuate fibres w cross to the opposite side forming sensory decussation then ascend as med. lemniscus to
- terminate on: Cells of PLVN of thalamus.
- Carry proprioception & fine touch from the opposite side of the whole body.



Tabes Dorsalis:

Syphilis causes destruction of n.fs of post root at point of entrance to sp.cord. esp. (lower $\frac{1}{2}$). causing:

1. Stabbing pain, parathesia & numbness in lower limbs.
2. Hypotonia (loss of proprioception from ms & joints).
3. Sensory ataxia in lower limbs → unsteady gait compensated by vision. On closure of eyes or in the dark, patient may fall.
4. loss of Knee & ankle tendon reflexes.

Pathway of Pain & Temperature [from body]

-4-

Receptor: free nerve endings.

1st Order Neuron:

= **Small** cells of the spinal ganglia.

Their peripheral branch = thin myelinated nerve fibres w receive sensation from receptor. Their central branches enter the sp. cord through the **lateral** division of the post. root & form **Lissauer's tract** w ascend or descend 1 or 2 segments to end on cells of:

2nd Order Neuron:

= Cells of **Substantia Gelatinosa of Rolandi S.G.R.**

Axons of these cells cross to the opposite side in front of the central canal & ascend as the **Lat. spino-thalamic tract** in the lat. column of the white matter & brain stem. In the pons, it joins the vent. spino thalamic tract to form the **Spinal lemniscus** that ends in: →

3rd Order Neuron:

= Cells of **posterolateral Ventral Nucleus of Thalamus [PLVNT]**

Their axons ascend in the sensory radiation to reach the sensory area in the post central gyrus of cerebral cortex [area 3, 1 & 2]

Pathway of Crude Touch [from body]

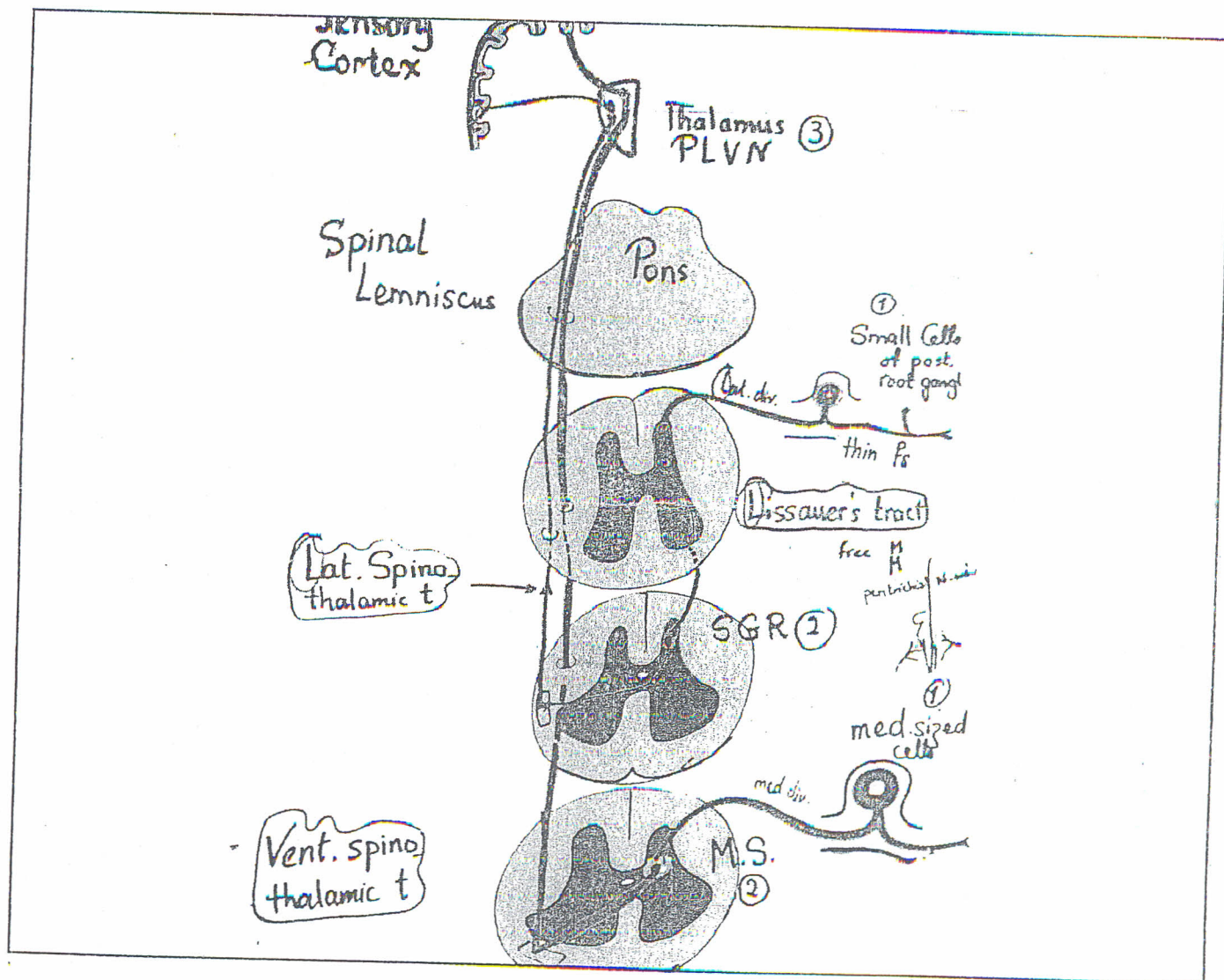
Receptors:

1. free nerve endings
2. peritrichial nerve endings.
3. Merkle's disc
4. Meissner's Corpuscles

1st Order Neuron:

= **Medium sized** cells of the spinal ganglia.

Their peripheral branch (**med. sized** myelinated n. fibres) receive sensation from the receptors. Their central branches enter the spinal cord through the **medial** division of the post. root to end on cells of:



= Cells of **Main Sensory N. [Nucleus Proprius]**

Their axons cross to the opposite side in front of the c.c. to form the **Ventral spinothalamic tract** in the vent. column of white matter of brain stem. In the pons, it joins the lat. sp. thalamic t to form **Spinal Lemniscus** w end on cells of:

3rd Order Neuron:

= Cells of **PLVNT**. Their axons ascend in sensory radiation to end in sensory area in the post central gyrus of cerebral cortex (area 3, 1 & 2)

Lat. Spinothalamic tract	Vent. sp. thalamic t.
def - long ascending sensory tract.	- long ascending sensory tract.
site - In lat. column of white matter of sp. cord (all levels)	- In vent. column of white matter of sp. cord (all levels)
Origin: Cells of SGR of opposite side	- Cells of MSN of opposite side
Course: axons of the cells <u>cross</u> to the opposite side & ascend <u>singly</u> lat. until the pons where it joins the v. sp. thalamic tract to form the spinal lemniscus.	- axons of the cells <u>cross</u> to the opposite side & ascend <u>singly</u> until the pons where it joins the lat. sp. th. tract to form the sp. lemniscus.
Terminatⁿ: Cells of PLVNT (opposite side)	- Cells of PLVNT (opposite side)
Functⁿ: Carry pain & temp. From " " of body.	- Carry Crude touch from " " of body.
Lesion: Contralat. loss of pain (pinprick) & temp. (hot & cold) below the lesion.	- Contralat. loss of Crude touch (piece of cotton) below the lesion.

Spinal Lemniscus

def: Ascending sensory bundle present in the brain stem. Formed by union of the lat. & vent. spinothalamic tracts. يشرحوا

Origin: the lat. sp. thalamic (cells of SGR) & vent. sp. thalamic (cells of MSN) of opposite side

Course: axons of these cells cross to the opposite side as lat. & vent. sp. thalamic tracts. In the pons they join → sp. lemniscus

Termination: Cells of **PLVN** of thalamus.

Function: carry pain & temp. + crude touch from the opposite side of body.

N.B the fs. for pain are ant. while fs. for temp. are post. in position.

Syringomyelia:

Congenital dilatation of C.C. of sp. cord in lower cervical & upper thoracic segments → press on lat. sp. thalamic t. → bilat. loss of pain & temp. in chest & upper limbs, while touch is preserved → dissociated sensory loss.

Pathways from the Face & Head

Pain & Temp. pathway

Receptors: free n. endings.

1st Order N: Cells in trigeminal ganglion

2nd Order N: Cells of spinal N of trigeminal nerve. axons cross & join the Trigeminal Lemniscus

3rd Order N: Cells of PMVN of thalamus. Axons end in sensory area of cereb. cortex

Crude Touch Pathway

Receptors: as in the body.

1st Order N: Cells in trigeminal ganglion.

2nd Order N: " " Main sensory N. Their axons cross & join the trigeminal lemniscus.

3rd Order N: Cells of PMVN of Thalamus. Axons end in sensory area of cereb. cortex

Proprioception & fine touch Pathway

Receptors: Muscle spindle & tendon spindle in muscles of mastication + Pacinian corpuscles in deep dermis.

1st Order N: Mesencephalic Nucleus (inside CNS). Their axons descend to end on

2nd Order N: Cells of Main sensory N. Their axons cross to join the trigeminal lemniscus.

3rd Order N: Cells of PMVN of thalamus. Axons end in sensory area of cereb. cortex.

Trigeminal Lemniscus

def: ascending sensory bundle in the brain stem.

Origin: Spinal nucleus & main sensory nucleus of trigeminal nerve.

Course: Their axons cross to the opposite side & join to form the trigeminal lemniscus in pons & mid brain & end in:

termination: PMVN of thalamus.

Function: carry pain, temperature, crude touch & proprioception from face & head (scalp) [opposite side].

